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## THE PREROGATIVES OF A STATE GEOLOGIST.

IT was with surprise that I noticed in a recent number of SCIENCE a communication on the 'Prerogatives of a State Geologist,' in which I am made the target of considerable unfair criticism. The temerity of its author, Mr. Erasmus Haworth, in distorting facts is not only a little astonishing, but smacks almost of deliberate endeavor to misrepresentation. Ordinarily it would not demand the slightest notice, but from the character of the presentation there might appear some plausibility to some of those who have no personal knowledge of the circumstances, of the animus of assault, or of the persons involved. I do not care to impose, even upon an indulgent public, an account of the various differences which have recently arisen between Mr. Haworth and myself. I only wish to make the statement, and that emphatically, that the charges made are either wholly false or are calculated to deceive. With the same data and by the same adroit manipulation of phrases and partial quotation it can be proved to the full satisfaction of the sunflower savant that the moon is made of green cheese.

CHARLES R. KEYES.

## COIN DISTORTIONS BY RÖNTGEN RAYS.

WE have repeated Professor Frost's interesting experiments on the distortion of coins (SCIENCE, N. S., Vol. III., No. 65, p. 465) in skiagraphs, but we have come to the conclusion that the distortion is due, not to electrostatic charges (as was suggested in the article referred to), but simply to umbras and penumbras formed by rays emanating from different points and falling upon coins of different thicknesses. In repeating Prof. Frost's experiments, we had the Crookes tube 14 mm. above the silver dollar and the film 3 mm. below the coins. We then placed the coins on a horizontal pane of glass and in the same position relative to the Crookes tube above them as when the skiagraph was taken. On holding a piece of paper up against the pane and examining by the eye, from below, the shadow cast by the coins in the light of the Crookes tube above, the very same distortion was seen that was shown in the skiagraph.

With the view of preventing X-rays having a large incident angle from striking the edges of the coins forming the curvilinear triangle, we placed upon the triangle a cylindrical section cut from the neck of a yellow-glass bottle. The section was ground down to a height of 11 mm., its internal diameter varied from 13 to 15 mm., its thickness was 5 mm. The distortion in the skiagraph was a trifle less than formerly, but more pronounced, we thought, than in the ocular test.

Fearing that the glass was somewhat transparent to X-rays, we replaced it by three iron washers superposed upon each other. Their internal and external diameters were 14 mm. and 34 mm. respectively, and their combined thickness was 9 mm. The tube, film and coins were in the same relative position as before. The skiagraph revealed much less distortion than in the first exposure. The ocular test with the washers on and with them off produced, as nearly as we could tell, exactly the same effects as were shown in the skiagraphs.

In another trial we discarded the washers and separated the coins from the film by only three thicknesses of black paper. The tube was again 14 mm. above the coins. As expected, the edges of the coins in the skiagraph were very sharp, and there was no trace of distortion. In this case the electrostatic charges must have been fully as pronounced as in the first experiment, but a perceptible penumbra could not have been formed. It would seem, therefore, that the distortion was due simply to umbras and penumbras cast by the coins.

FLORIAN CAJORI,  
WILLIAM STRIEBY.

COLORADO COLLEGE,  
April 10, 1896.

## SCIENTIFIC LITERATURE.

## THE ERUPTIVE SEQUENCE.

*Die Eruptivgesteine des Kristianiagebietes II. Die Eruptionsfolge der triadischen Eruptivgesteine bei Predazzo in Südtirol.* Von DR. W. C. BRÖGGER. Videnskabselskabets Skrifter, I. Mathematisk-Naturv. Klasse. 1895, No. 7. Kristiania.  
After many years of exhaustive research

Brögger is now giving to science the results of his labors on the rocks of southeastern Norway in a series of memoirs of which the one before us is the second. Various preliminary papers and the classic monograph, *Die Mineralien der Syenitpegmatitgänge*, have stimulated petrologists to a keen anticipation of the magnificent contribution which should accrue to their science by the publication of Brögger's work. The first two memoirs amply justify these anticipations; and it is becoming apparent that the work will be an epoch-making event in the history of the science, and will result in the establishment, on a sure basis, of the principle of *magma differentiation* as one of the most important factors, if not the all-controlling factor in the genesis of rock types. Toward this principle, or rather toward a full comprehension of its scope, petrology has been groping rather vaguely for the last ten years, and we now seem to have arrived at a point when knowledge is beginning to crystallize from the all-pervading magma of ignorance. Among those prominent in contributing to the modern conception of differentiation Brögger is *facile princeps*, and it is fortunate for the science of petrology that a field so rich in possibilities of demonstration of the differentiation hypothesis should have fallen to the lot of so keen and masterful an investigator.

The subject-matter of the paper may be stated under the following heads:

1. The establishment of a new family of plutonic rocks, designated the *monzonites*.
2. A discussion of the eruptive sequence near Predazzo.
3. A discussion of the mechanism of plutonic eruption, involving
4. The proof of the laccolitic character of the plutonic rocks of the Christiania region.
5. A comparison of the eruptive sequence near Predazzo and Monzoni with that in the Christiania region.
6. The formulation and discussion of the law of plutonic sequence, involving
7. The discrimination between the sequence of plutonic and that of volcanic rocks.

A few words by way of summary and comment may be of service as indicative of the trend of thought in modern petrology.

The term monzonite has been used by differ-

ent writers in various senses as a comprehensive and as a special designation for certain rocks occurring in the classic environs of Predazzo and Monzoni. The confusion arising from the various usages of the term is historically reviewed, and it is pointed out that, however various the usage, the rocks designated as monzonites have been, with one exception, by all writers, referred to the family of the Diorites, or plagioclase rocks, or to the Syenites, *i. e.*, orthoclase rocks. A review of the literature and of the rocks themselves leads Brögger to the view that the latter are properly to be classed with neither of these two families, but are characterized by approximately equal occurrence of both alkali feldspars and lime-soda feldspars. This being so, he claims for them recognition as a distinct family of plutonic rocks intermediate between those characterized by the prevalence of orthoclase (alkali feldspar) and those characterized by the predominance of plagioclase (lime-soda feldspar).

After an exhaustive review of the chemical characters of the monzonites and a discussion of their relations to other families of rocks, he formally defines them as an order of transition rocks between the orthoclase and the plagioclase rocks, of true plutonic character. They are of intermediate basicity ( $\text{SiO}_2$ —49–62 per cent.), with a moderate lime contents (6–7 per cent.) and about the same contents of alkalis in equal proportion; high in alumina (17–18 per cent.) and relatively low in magnesia. Various subdivisions of the monzonites are recognized, such as *pyroxene-monzonite*, *hornblende-monzonite*, etc.

The establishment of the monzonites as a separate family of plutonic rocks as above defined is important in the emphasis which it places upon the inadequacy of the present scheme of classification to accommodate all rocks, and as expressive of a strong tendency among petrologists to expand the nomenclature.

The eruptive sequence near Predazzo and Monzoni is formulated as follows:

1. Oldest—Dykes and flows of basic rocks.
2. Corresponding to the latest of these are basic plutonic rocks.
3. More acid rocks—Monzonites, represented by volcanic flows of plagioclase porphyrite.

4. Biotite granite with contact facies of tourmaline granite.

5. Complementary dykes of camptonite and nepheline-bostonite-porphry.

The discussion of the mechanism of plutonic eruption consists chiefly in a vigorous attack upon the 'assimilation hypothesis' of Michel-Lévy based upon its utter failure to explain the facts of the Christiania region. The assimilation hypothesis has much in common with a similar hypothesis put forward earlier by Kjerulf and involves the assumption that plutonic *massifs* have pierced the crust by a process of fusion of the region invaded and consequently of an absorption of a portion of the crust, thus explaining the common abutment upon these massifs of different stratigraphic horizons of the region invaded. Brögger combats this view, as it appears successfully, as applied to the Christiania region, and shows that the plutonic rocks have a laccolitic, and not a batholithic, relation to the Silurian strata which they invaded. This constitutes a very important advance in our conceptions of laccolites, the Christiania laccolite being by far the most extensive now known. The assimilation idea is disproved by the fact that although the igneous magmas invaded Silurian limestone, the analyses of the rocks show no enrichment of lime near the contacts; and the fact that the plutonic rocks transgress the ruptured edges of the Silurian strata, with the local absence of the lower members, is shown to be probably due to the fact that the latter underlie the laccolite and have not been absorbed by it. While the assimilation theory thus breaks down when applied to the Christiania region, it is by no means certain that it is not the true explanation of the origin of many other more extensive areas of plutonic rocks, as Brögger admits.

The essential features of the assimilation hypothesis were formulated by the reviewer some years ago, before the publication of Michael Lévy's views, and urged as a satisfactory explanation of the remarkable relations which obtain between the Laurentian granites and gneisses and the upper Archæan or Ontarian metamorphic rocks. These intrusive granites and gneisses occupy vast tracts of the Canadian Archæan plateau and there seems to be no escape from

the view that they bear a batholithic relation to the crust which they invaded from below. Portions of the crust were absorbed, but there are two possibilities as to the method of absorption viz: 1. By fusion; 2. By sinking into the magma. The numerous blocks of rocks scattered through the granites lends much probability to the latter having played a part in the process. Such batholiths were doubtless accompanied by laccolitic satellites.

In his comparison of the eruptive sequence in the Tyrol and Christiania regions Brögger finds an essential identity to the extent that the eruptive activity yielded first basic rocks, then those of intermediate acidity, then acid rocks and finally a reappearance of basic rocks in limited amount in the form of dykes.

The evidence bearing upon the sequence of plutonic eruption, drawn from the records of various well-known fields of geological research, is next placed in review and leads our author to the formulation of a general or normal law of sequence, which states, that plutonic rocks appear in any field in the order '*basic, less basic, acid.*' The sudden return to basic intrusions succeeding the acid is not sufficiently constant to warrant it being made part of so general a proposition. This law of succession is at variance with other attempts at the formulation of a general law, but all such former attempts have either been concerned with volcanic rocks solely, or have failed to discriminate between the volcanic and the plutonic. The necessity is urged of investigating the succession of these two classes of rocks separately. The discrimination will undoubtedly lead to an elimination of much of the confusion which exists in geological literature on these interesting questions.

In graceful compliment to American research, the volume is dedicated by its author to Prof. J. P. Iddings, of the University of Chicago.

ANDREW C. LAWSON.

BERKELEY, March 11, 1896.

*Electric Wiring.* By RUSSELL ROBB. Macmillan & Co., New York. 183 pp., 76 cuts. Price, \$2.50.

This book is intended for the use of architects, underwriters and the owners of buildings.

In the first and second chapters the author explains, in a very clear manner and in a non-technical language, the properties of wires carrying currents of electricity. The particular features treated are those which have a bearing on danger from fire and the proper proportioning of wires to avoid such danger. Chapter III. deals with the series, the multiple and the three-wire systems. There are excellent diagrams showing what these systems are, and the text explains how they are operated. Chapter IV. gives a brief account of methods of wiring, particular attention being given to the reasons which make the conduit system the most desirable for the better class of modern buildings. The remaining chapter gives the National code of rules for wiring as applied to Central Stations, High-Potential Systems, Low-Potential Systems, Alternating Systems, Electric Railways and Batteries. These rules are all quoted in full, and each rule is followed by a full explanation of the reasons for its adoption and the dangers which it is the object of the rule to avert. The rules contain many technical words which are explained. It is evident that this is the kind of information which will conduce to the more general carrying out of these rules in practice. The house owner will see that they are designed to protect this property, and not simply to annoy him by useless restrictions. The book is well written and contains information that no house owner can afford to ignore if he is called upon to deal with electric wiring.

FRANCIS E. NIPHER.

#### SCIENTIFIC JOURNALS.

##### THE AUK.

THE *Auk* for April is a number of rather more than usual interest. The opening article, by William Palmer, 'On the Florida Ground Owl (*Speotyto floridana*),' treats in detail of the peculiar distribution and breeding habits of this hitherto little known species, and is illustrated by a colored plate of the bird, a diagram of one of its breeding sites, and a cut showing in section one of its burrows. Mr. F. A. Lucas writes of 'The Taxonomic Value of the Tongue in Birds,' illustrated with figures of the tongue in 12 species, showing the relation of its struc-

ture to the food habits in different groups of birds.

Miss Florence A. Merriam has interesting 'Notes on Some of the Birds of Southern California,' and the well-known artist, Abbott H. Thayer, has a very suggestive paper on 'The Law which Underlies Protective Coloration,' with cuts in the text and five full-page photographic illustrations. In short, Mr. Thayer's newly discovered law is to the effect that 'animals are painted by nature, darkest on those parts which tend to be most lighted by the sky's light, and *vice versa*.' This is illustrated by a series of ingenious experiments with the Ruffed Grouse and Woodcock, showing that when the darker 'protective' tints of the upper surface are artificially extended over the lighter lower parts the bird becomes 'completely unmasked.' The artificial extension of the top colors over the lower parts destroys the counter-gradation of colors imposed by nature and forces the bird's solidity to manifest itself.

Dr. Louis B. Bishop describes a new Song Sparrow and a new Horned Lark from North Dakota, and George K. Cherrie a new Night-hawk from Costa Rica. Witmer Stone publishes a revision of the North American Horned Owls, describing also a new species. Some sixteen pages are devoted to a critical examination, by J. A. Allen, of Gätke's 'Heligoland as an Ornithological Observatory, the Result of Fifty Years' Experience'—a book that has attracted wide attention and in general has received high praise. Mr. Allen, however, shows that its merits have been often greatly overrated, and its faults either wholly overlooked or very leniently mentioned. While 'Heligoland' is an important contribution to the literature of ornithology, "it contains much that is set forth as fact which proves on close examination to be mere conjecture." This is especially true of Chapter IV., on the 'Velocity of the Migration Flight,' where, on very slight evidence and in opposition to an abundance of rebutting testimony, it is claimed that most birds perform under normal conditions their migratory journeys in 'one uninterrupted nocturnal flight, \* \* accomplishing a distance of at least 1,600 geographical miles within the space of nine hours.' He even considers that the Red Spotted Blue-